

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 317 023 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.06.2003 Bulletin 2003/23

(51) Int Cl.7: H01R 13/514, H01R 13/66

(21) Application number: 02026460.2

(22) Date of filing: 27.11.2002

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SK TR
Designated Extension States:
AL LT LV MK RO SI

- Aeschbacher, Michel
25320 Grandfontaine (FR)
- Brubaker, Brad
Mechanicsburg, PA 17055 (US)
- Marshall, Robert
Elizabethtown, PA 17022 (US)
- Spickler, John
Columbia, PA 17512 (US)
- Wheeler, Bonita L.
Red Lion, PA 16838 (US)

(30) Priority: 28.11.2001 US 996556

(71) Applicant: FCI
75009 Paris (FR)

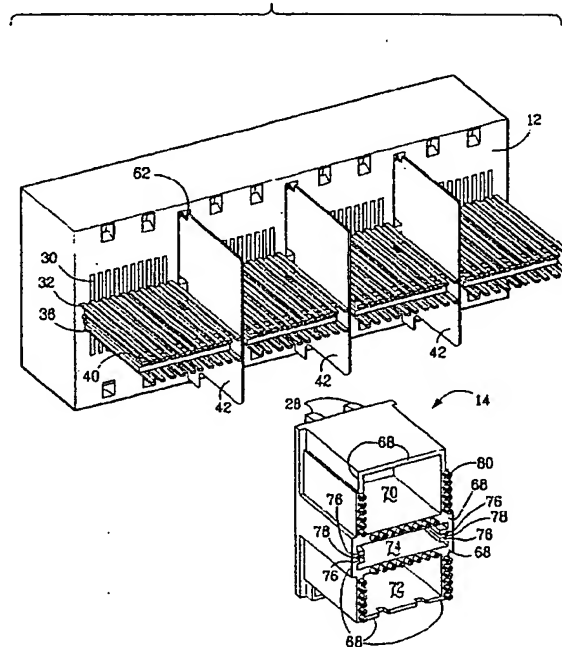
(72) Inventors:
• Belopolsky, Yakov
Harrisburg, PA 17112 (US)

(74) Representative: Beetz & Partner Patentanwälte
Steinsdorfstrasse 10
80538 München (DE)

(54) A modular jack with magnetic components

(57) A modular jack for housing magnetic components includes a housing (12) which has a plurality of ports each of which can receive an electrical connector. Extending into each of the ports are a plurality of contacts for connecting to contacts of an electrical connector. The ports may be arranged in a stacked configuration in which case the modular jack is a double deck jack. Attached to the housing may be one or more magnetic housing (14). Each magnetic housing can house at least one magnetic component, which can be a transformer. Preferably, there is a magnetic housing for every two ports, and the magnetic housing houses a magnetic component for each port. Shields (40, 42) can be installed into the housing between the magnetic components in order to provide isolation of the components. A printed wire board can be attached to the magnetic housing, and a contact carrier having a plurality of contacts can be attached to the printed wire board

FIG. 6



EP 1 317 023 A2

Description

Field of the Invention

[0001] This invention relates to electrical connectors including a modular jack that can house magnetic components.

Background of the Invention

[0002] Various types of modular jacks exist in the prior art. Typically, such jacks are used for connecting electrical components. The Electronics Industry Association and the Telecommunications Industry Association have established categories of such modular jacks, which those skilled in the art will recognize as category 3, category 4 and category 5. Various types of modular jacks have been developed including those set forth in Berg Technology, Inc.'s U.S. Patent Nos. 5,879,199 and 6,036,547. This invention relates to an improved modular jack and includes an improved modular jack which can house a magnetic component.

Summary of the Invention

[0003] A modular jack for housing a magnetic component according to this invention includes a housing and a magnetic housing coupled to the housing. The housing has at least one port for receiving an electrical connector, and the magnetic housing has at least one enclosure for housing a magnetic component. The modular jack can connect to two electrical components including for example a printed circuit board and a connector. The connector is preferably sized and shaped so as to correspond to the size and shape of the port, so that the connector can be inserted into the port and be placed in electrical communication with the housing.

[0004] The housing may have a plurality of ports, which may be disposed such that there are two rows of ports. An electrical connector can be inserted into each of the housing ports. When the jack has two rows of ports, it may be known as a double deck modular jack. The housing preferably has a wall with a plurality of grooves and a plurality of contacts extending through the grooves into the ports. When an electrical connector is inserted into one of the ports, the connector's contacts mate with the housing contacts which extend into the respective port.

[0005] The magnetic housing may have two enclosures each of which can house a magnetic component. The jack may have a plurality of magnetic housings and preferably one magnetic housing for every two ports which are disposed in vertical alignment with each other. The magnetic housing may also have an enclosure through which the contacts extending from the ports extend.

[0006] Extending from the magnetic housing may be a plurality of wire retaining members. When a magnetic

component is placed within an enclosure of the magnetic housing, the wires extending from the magnetic component can be threaded through the wire retaining members. Preferably, the wire retaining members have two prongs so that the wire can be threaded between the prongs.

[0007] The jack may also have a plurality of shields which are disposed proximate to each enclosure of the magnetic housing. The shields provide magnetic insulation for the magnetic components disposed within the magnetic housing. The shields may be disposed in a vertical pattern between each magnetic housing and in a horizontal pattern between each enclosure of the magnetic housing.

[0008] The jack may further include a printed wire board having a plurality of holes. The wire retaining members of the magnetic housings and the contacts extending from the ports of the housing can extend through the holes to the printed wire board.

[0009] The jack may also have a contact carrier which is coupled to the magnetic housing. Disposed within the contact carrier may be a plurality of contacts. One end of the contacts can extend through the holes in the printed wire board. The other end of the contacts can extend from the contact carrier. When the modular jack is connected to another electrical component, such as a printed circuit board, the contacts extending from the contact carrier can be placed in electrical communication with the electrical component.

[0010] The jack of this invention can house a magnetic component, but it need not. The jack can be sold and used with and without magnetic components and thereby provide a single jack that can be used in either application.

[0011] Other features of the invention are described below.

Brief Description of the Drawings

[0012]

Fig. 1 is a perspective view of a jack according to a preferred embodiment of this invention;

Fig. 2 is a back perspective view of the jack of Fig. 1;

Fig. 3 is a perspective view of a preferred embodiment of a housing of the jack of Fig. 1 with the contacts, horizontal shield and vertical shield removed;

Fig. 4 is a perspective view of the housing of Fig. 3 with the contacts installed;

Fig. 5 is a perspective view of the housing of Fig. 5 with the contacts and horizontal shields installed;

Fig. 6 is a perspective view of the housing of Fig. 2 with the contacts horizontal shields and vertical

shields installed and of a magnetic housing according to a preferred embodiment of this invention;

Fig. 7 is an assembly drawing of the housing of Fig. 2 with a plurality of magnetic housings of Fig. 6 installed and a preferred embodiment of a contact carrier shown in Fig. 1 removed;

Fig. 8 is a front perspective view of the magnetic housing of Fig. 6;

Fig. 9 is a back perspective view of the magnetic housing of Fig. 6;

Fig. 10 is a cross section taken along line 10-10 of Fig. 8 with a magnetic component installed;

Fig. 11 is a perspective view of a portion of the contact carrier of Fig. 7 with the contacts removed;

Fig. 12 is a perspective view of the under side of the contact carrier of Fig. 7; and

Fig. 13 is a cross section taken along line 13-13 of Fig. 1 with a wire installed.

Detailed Description of Preferred Embodiments

[0013] A perspective view of a preferred embodiment of the modular jack 10 of this invention is depicted in Fig. 1. As shown, the modular jack 10 preferably includes a housing 12, a magnetic housing 14 and a contact carrier 16. Each of these components can be assembled by any of a variety of fastening techniques a preferred embodiment of which is described below. A printed wire board (PWB) 18 can also be used with the jack 10 and is preferably installed as shown in Fig. 1.

[0014] The housing 12 is preferably formed from a thermoplastic material, but any suitable material can be used. The construction of the housing is best understood with reference to Figures 1-6. As shown in Fig. 2, which is a elevation view of the back of the housing 12, the housing preferably has at least one port 20 for receiving an electrical connector such as a standard jack (not shown). In the preferred embodiment shown, the housing 12 has 8 ports 20, but it will be appreciated that the housing 12 can be constructed with any number of ports 20. Moreover, although the preferred embodiment shown has two rows of ports 20 and may be referred to as a "double deck modular jack," it will be appreciated that the broad concepts of the invention expressed herein are not limited to any number of ports 20 or their specific arrangement.

[0015] The ports 20 are preferably designed to receive a standard electrical connector. In the embodiment shown, the ports are defined by a plurality of walls 22 that are shaped to specifically receive the connector for which the housing 12 is designed.

[0016] As shown in Fig. 3, which is a perspective view of the front of the housing 12, the housing 12 has a front side 24 which preferably has a plurality of openings 26. These openings 26 are for receiving snaps 28 of the magnetic housing 14 as described in further detail below, so that the magnetic housing 14 can be snap fit to the housing 12, as best understood with reference to Figures 1, 6 and 7. This is a preferred method of attaching the housing 12 and the magnetic housing 14 and any of a variety of other fastening techniques including but not limited to metal fasteners and adhesives can be employed.

[0017] Disposed within the front side 24 of the housing 12 are a plurality of grooves 30 as shown in Fig. 3. Preferably, each of the grooves 30 can receive a contact 32, a plurality of which are depicted in Fig. 3. Preferably, the grooves 30 can be divided into groups 34 which each correspond to a port 20. Each groove 30 within a set extends through the front side 24 and into the one of the ports 20 as is best understood with reference to Fig. 2-4.

[0018] Extending from the front side 24 are preferably a plurality of fins 36 as shown in Fig. 3. The fins 36 can be molded as one piece with the housing 12 or alternatively the fins 36 can be separate pieces that are fit into slots 38 within the housing 12. The fins 36 are attached to the slots 38 within the housing 12 by any suitable means including but not limited to snaps, interference fits, mechanical fasteners and adhesives. As best shown in Fig. 4, the fins 36 define surfaces over which the contacts 32 extend.

[0019] The housing 12 preferably has a horizontal shield 40, as best shown in Figures 4 and 6, and at least one vertical shield 42, as best shown in Figures 5 and 6. The horizontal and vertical shields 40 and 42 are preferably each constructed from a thermoplastic material, but any suitable material will suffice. The horizontal shield 40 is preferably formed as a single piece. Alternatively, the horizontal shields 40 can be constructed from multiple pieces and fastened together with any suitable fastening technique. The vertical shields 42 are preferably formed as multiple pieces, as shown in Fig. 5.

[0020] As shown in Fig. 4, the horizontal shield 40 preferably includes a plurality of planes 46 which are connected by members 48. An end 44 of each plane 46 can be received into a slot 48 disposed within the housing 12. The horizontal shield 40 preferably has a plane 46 for every two vertically disposed ports 20. Extending from the two outer most planes 46 are a protrusion 50. When the planes 46 are inserted into the slots 48 of the housing 12, the protrusions 50 fit within a recess (not shown) which holds the shield 40 in the slots 40. Other suitable connection means may be employed including but not limited to an interference fit, mechanical fasteners and adhesives. The function of the horizontal shields 40 is to provide magnetic insulation between the first and the second enclosures.

[0021] As best shown in Figures 5 and 6, the vertical shields 42 are preferably all alike and each have a first

extension 52 and a second extension 54. Disposed within the housing 12 are preferably a pair of slots 58 (one of which is shown in Fig. 5, but it will be appreciated that the lower slot has the same configuration as the upper slot) for each vertical shield 42. Within the slots 58, as shown in Fig. 5, are rails 60 which define grooves 62. Grooves 62 are shaped and sized to tightly receive an extension 52, 54 of one of the vertical shields 42 in an interference fit and hold the vertical shield 42 in place. Fig. 6 depicts the vertical shields 42 inserted into the slots 58 and grooves 62 so that the vertical shields 42 are attached to the housing 12. The vertical shields 42 may also have an extension which fits into a corresponding slot (not shown) in the bottom most groove 62 to further support the electrical shield 42 when installed in the housing 12. Other fastening techniques may be employed. The function of the vertical shields is to magnetic insulate the magnetic components that are horizontally disposed in the magnetic housings, as described in more detail below.

[0022] As discussed above and as shown for example in Figures 2 and 3, the housing 12 preferably includes a plurality of contacts 32. In the preferred embodiment, the contacts 32 each have a first portion 32a that extends along one of the fins 36. Extending at an angle from the first portion 32a is a second portion 32b. Third portion 32c extends laterally from the second portion 32b. Each contact 32 preferably has a generally u-shaped portion 32d, and another lateral extending portion 32e. It will be appreciated that the contact 32 is constructed from metal and is relatively flexible. When the contacts 32 are inserted into the grooves 30, the laterally extending portions 32e are compressed by walls within the housing as best understood by reference to Fig. 2, which depicts the rear of the housing with the contacts 32 extending through the grooves 30. It will be appreciated that when a corresponding connector (one which corresponds to the port) is inserted into the port 20 the contact of the connector will contact and flex the contacts 32 to provide an electrical connection between the connector and the jack, as best understood with reference to Fig. 2.

[0023] Fig. 6 depicts the front of the housing 12 with the contacts 32, the horizontal shields 40 and the vertical shields 42 installed, and one of the magnetic housings 14 removed. Figures 1 and 7 depict the housing 12 with a plurality of magnetic housings 14 coupled to the housing 12. It will be appreciated that Fig. 7 is a depiction of Fig. 1 with the printed wire board removed so that the assembly of the housing 12 and the magnetic housings 14 can be better understood. In a preferred embodiment, the jack 10 has a plurality of magnetic housings 14. Alternatively, it will be appreciated that the plurality of magnetic housings 14 can be constructed in one piece. Preferably, each magnetic housing 14 is constructed to correspond to two ports, a lower and a corresponding upper port, as shown in Figures 6 and 7.

[0024] The jack 10 preferably has a plurality of mag-

netic housing 14 of the type shown in Figures 6, 8 and 9. Fig. 8 a front perspective view depicting the lower portion of the magnetic housing of Fig. 6, and Fig. 9 is a rear perspective view depicting the back of the magnetic housing 14 of Fig. 6. As best shown in Fig. 9, each magnetic housing 14 preferably has a plurality of snaps 28. In the preferred embodiment shown and as best understood with reference to Figures 6, 7 and 9, the snaps 28 fit into the openings 26 of the housing 12 in order to assemble the magnetic housings 14 to the housing 12. Preferably, there are two sets of snaps 28, one at the upper part of the magnetic housing 14, and one at the lower part, as shown in Fig. 9. Although snaps 28 are used in the preferred embodiment shown, any suitable means may be used to attach the magnetic housings 14 to the housing 12.

[0025] As shown in Fig. 8, the magnetic housings 14 may have a lower portion 64, which has holes 66. Holes 66 are for receiving a portion of the contact carrier 16 and attaching the contact carrier 16 to the respective magnetic housing 14.

[0026] As is best shown in Figures 6, 8 and 9, the magnetic housings 14 each have a plurality of walls 68 which define a first enclosure 70, a second enclosure 72 and a third enclosure 74. The third enclosure 74 is, as will be appreciated with reference to Fig. 7, for receiving the contacts 32 of an upper and a corresponding lower port 20 as well as a fin 36 and a horizontal shield 40. As shown in Figures 6, 8 and 9, the portion of the walls 68 which define the third enclosure 74 may have a pair of rails 76 which define a groove 78. The grooves 78 are sized and shaped so as to receive a fin 36, as best understood with reference to Figures 6 and 7. Other mechanisms may be used to support the fins 36 as they extend into the magnetic housing 14 when the magnetic housing 14 is assembled to the housing 12 as shown in Fig. 7.

[0027] The first enclosure 70 and the second enclosure 72 are each for housing at least one magnetic component 88, including but not limited to a choke or a transformer.

[0028] One such magnetic component 88 is depicted in Fig. 10, the cross-section taken through Fig. 7. The specific magnetic component 88 housed in the first and the second enclosures 70, 72 depends upon the application of the jack 10.

[0029] The magnetic housing 14 may further have a plurality of wire retaining members 80, as shown in Fig. 8. Wire retaining members 80 can be integrally formed with the magnetic housing 14 or attached as separate components. Although the wire retaining members can have a variety of embodiments, in the embodiment depicted the each wire retaining members includes prongs 82, 84. Fig. 10 depicts a cross-section taken through line 10-10 of Fig. 7. As shown, a wire 86 can be threaded through the wire retaining member 80. The wire 81 extends from a magnetic component 88, as shown in Fig. 10, which is housed in the respective enclosure of the

magnetic housing 14. As shown in Fig. 10, the wire 81 extends from a wire retaining member 80 on one side of the magnetic housing 14 to a wire retaining member 80 on the other side of the magnetic housing 14.

[0030] As shown in Fig. 7, the magnetic housing 14 has a plurality of wire retaining members 80. The magnetic housing 14 can be manufactured to have the desired number of retaining members 80. In the preferred embodiment shown, the wire retaining members 80 are disposed so that they extend from the front side of the magnetic housing 14 and along three sides of the first and the second enclosures 70, 72. Wires 81 from the magnetic component 88 can be threaded into the wire retaining members 80 in any pattern desired. The wire retaining members 80 can also be used to connect the magnetic housings 14 to the printed wire board 18, as shown in Fig. 1 and as described in more detail below.

[0031] Figures 1 and 2 depict an embodiment of a contact carrier 16, which can be used with a preferred embodiment of this invention, installed into the jack 10. Fig. 2 depicts the underside of the contact carrier 16 when installed into the jack 10. Fig. 7 depicts a perspective view of the top of the contact carrier 16, and Fig. 12 depicts a perspective view of the contact carrier 16 as viewed from its underside. Fig. 11 depicts a perspective view of the contact carrier 16 with the contacts 96 removed.

[0032] The contact carrier 16 can be manufactured from a thermoplastic or any suitable material, and may be formed through a molding process. As shown in Fig. 7, the contact carrier 16 may have a plurality of tabs 90 extending from its rear side. Preferably, there are a corresponding number of tabs 90 for the number of holes 66 of the magnetic housing 14. The tabs 90 preferably are sized and shaped so as to fit snugly within holes 66 of the magnetic housing 14 as best understood with reference to Figures 1, 7 and 8. This creates an interference fit between the carrier 16 and the magnetic housing 14. Other attachment techniques can be utilized including but limited to other mechanical means including fasteners and adhesives.

[0033] Disposed within the contact carrier 16 may be a plurality of walls 92, which define a plurality of lateral grooves 94, as best shown in Figures 11 and 12. Each groove 94 can receive a contact 96, as best shown in Fig. 11. The lateral grooves 94 are preferably sized and shaped to correspond to the contacts 96. In the preferred embodiment shown, the contacts 96 are bent at approximately a right angle and have a first portion 96a that fits within the lateral grooves 94. As shown, in Fig. 12, the contacts 96 are preferably sized so as to extend from the contact carrier 16 so that they can interface with another component such as a printed wire board 18, as described below and as shown in Fig. 1.

[0034] The contact carrier 16 may also have a plurality of vertically extending openings 98, as shown in Fig. 11, into which a second portion 96b of the contacts 96 are inserted. Again, the openings 98 are sized and shaped

to correspond to the contacts 96 so that when inserted the contacts 96 will fit snugly within the contact carrier 16. Again, other suitable means may be used to install the contacts 96. The contacts 96 preferably extend from the contact carrier 16, so that the contacts 96 can interface with another electrical component, including but not limited to a printed circuit board.

[0035] As shown in Fig. 1, the jack 10 can include a printed wire board 18. The printed wire board 18 preferably has a plurality of openings 102 for receiving contacts 96 of the contact carrier 16, contacts 32 of the housing 12 or wire retaining members 80 of the magnetic housings 14, as shown in Fig. 1. The openings 102 can be disposed in any suitable pattern that corresponds to the arrangement of contacts 96 on the contact carrier, the arrangement of contacts 32 in the housing 12 and the arrangement of the wire retaining members 80. The printed wire board 18 can be connected to the magnetic housings 14 and the contact carriers 16 by any suitable connection technique. The printed wire board 18 can also have circuits for any of a variety of applications.

[0036] Fig. 13 depicts a cross section taken along line 13-13 of Fig. 1 and shows the connection of the wire 81 from a magnetic component 88, which is shown in Fig. 10. As discussed above, the wire 81 from a magnetic component housed in the first enclosure can be threaded through the wire retaining member 80. The printed wire board 18 can be coated with a metal layer 104 around the part of the wire board which defines each opening 102. The metal layer serves to provide the electrical connection between the wires 81 and the printed wire board 18.

[0037] When assembling the jack 10, the contacts 32, the horizontal shields 40 and the vertical shields 42 are inserted into the housing 12 as best understood with reference to Fig. 3-5. After which the magnetic housings 14 can be installed into the housing 12. Magnetic components can be inserted into the magnetic housings 14 and installed by wrapping the wires around the wire retaining members 80, as shown in Figures 10 and 11. The contact carrier can be attached to the magnetic housings 14 as shown in Fig. 1. The printed wire board 18 can then be attached to the magnetic housings 14 and the contacts of the contact carrier 16. This forms a jack 10 according to a preferred embodiment of this invention.

[0038] The jack 10 can have a variety of applications and is capable of housing magnetic components 88. For instance, the jack 10 can be coupled to a printed circuit board (not shown) and the ports 20 in the housing 10 can each receive an electrical connector (not shown), so that electrical signals can be transmitted between the connector through the jack 10 and to the component such as the printed circuit board.

[0039] Although the modular jack of this invention has a magnetic housing, it can be used with or without a magnetic component. Thus, the jack 10 provides a

standard part that is versatile. The jack 10 can be stocked and if it is to be used with a magnetic component, such a component can be inserted into the housing. Conversely, if no magnetic component is to be used, the jack 10 can be used without any such component. [0040] It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

Claims

1. An electrical connector including a modular jack (10) comprising a first housing (12) comprising at least one port (20), **characterized in that** a first magnetic housing (14) is coupled to the first housing and comprises a first enclosure (70) for housing a first magnetic component (88) and a second enclosure (74), a first set electrical contacts (32) extending from the port and through the magnetic housing second enclosure (74), and a contact carrier (16) coupled to the magnetic housing and comprising a second set of electrical contacts (96).
2. The electrical connector according to claim 1, **characterized in that** it further comprises a printed wire board (18) coupled to the magnetic housing.
3. The electrical connector according to claim 2, **characterized in that** the first and the second set of contacts (32, 96) extend through the printed wire board and are in electrical connection with the printed wire board.
4. The electrical connector according to claim 1, **characterized in that** the first magnetic housing further comprises a plurality of wire retaining members (80).
5. The electrical connector according to claim 1, **characterized in that** the first magnetic housing further comprises a third enclosure (72) for housing a second magnetic component.
6. The electrical connector according to claim 5, **characterized in that** it further comprises a shield (40) disposed between the first and the third magnetic housing enclosures.
7. The electrical connector according to claim 1, **characterized in that** the first housing further comprises a second magnetic housing disposed adjacent to the first magnetic housing and **in that** the jack further comprises a shield (42) disposed between the first and the second magnetic housings.
8. The electrical connector according to claim 1, **characterized in that** the shield is disposed within slots (58) disposed in the first housing.
9. A modular jack, comprising:
 - (a) a housing (12) having :
 - a plurality of ports (20), each of the ports being for receiving an electrical connector; a front wall (24) which defines a side of the plurality of ports and which has a plurality of grooves (30) and a plurality of openings (26); a plurality of first contacts (32) which extend through the grooves (30) and into the plurality of ports;
 - (b) a magnetic housing (14), coupled to the housing (12), having :
 - a plurality of walls (68) which define a first enclosure (70) and a second enclosure (72) each of which can receive a magnetic component (88); a plurality of wire retaining members (80) extending from the magnetic housing (14) for receiving a wire from the magnetic component;
 - (c) a contact carrier (16) coupled to the magnetic housing (14) comprising a plurality of second contacts (96).
 10. The modular jack according to claim 9, **characterized in that** it further comprises a printed wire board (18) having a plurality of openings (102) through which the plurality of first contacts (32), the plurality of second contacts (96) and the wire retaining members (80) extend.
 11. The modular jack according to claim 9, **characterized in that** a shield (40) is disposed between the first and the second enclosures.
 12. The modular jack according to claim 9, **characterized in that** the magnetic housing (14) further comprises a third enclosure (74) through which the plurality of first contacts (32) extend from the housing (12) to the printed wire board.
 13. The modular jack according to claim 9, **character-**

ized in that it further comprises a magnetic housing for every two ports (20) of the housing.

14. The modular jack according to claim 13, **characterized in that** a shield (42) is disposed between each magnetic housing. 5
15. The modular jack according to claim 9, **characterized in that** a contact carrier (16), coupled to the magnetic housing, houses a plurality of second contacts (96), the plurality of second contacts (96) each comprising a first end which extends through one of the openings (102) of the printed wire board. 10
16. The modular jack according to claim 15, **characterized in that** the plurality of second contacts (96) further comprise a second end which extends from the contact carrier (16) so that the modular jack can be placed in electrical communication with an electrical component. 15
20
17. The modular jack according to claim 16, **characterized in that** it comprises a plurality of magnetic housings. 25
18. The modular jack according to claim 17, **characterized in that** a shield is disposed between each magnetic housing.
19. The modular jack according to claim 9, **characterized in that** the magnetic housing (14) comprises two enclosures each of which can receive an electrical component. 30
20. The modular jack according to claim 19, **characterized in that** a shield is disposed between the enclosures. 35
21. The modular jack according to claim 9, **characterized in that** a first magnetic housing (14), coupled to the first housing (12), comprises a first enclosure (70) for housing a first magnetic component (88), a second enclosure (74), and a third enclosure (72) for housing a second magnetic component. 40
45
22. The modular jack according to claim 9, **characterized in that** a second magnetic housing is disposed adjacent to the first magnetic housing and **in that** it comprises a second shield (42) disposed between the first and the second magnetic housings. 50
23. The modular jack according to claim 22, **characterized in that** the second shield is disposed within grooves (30) provided for in the first housing (12). 55

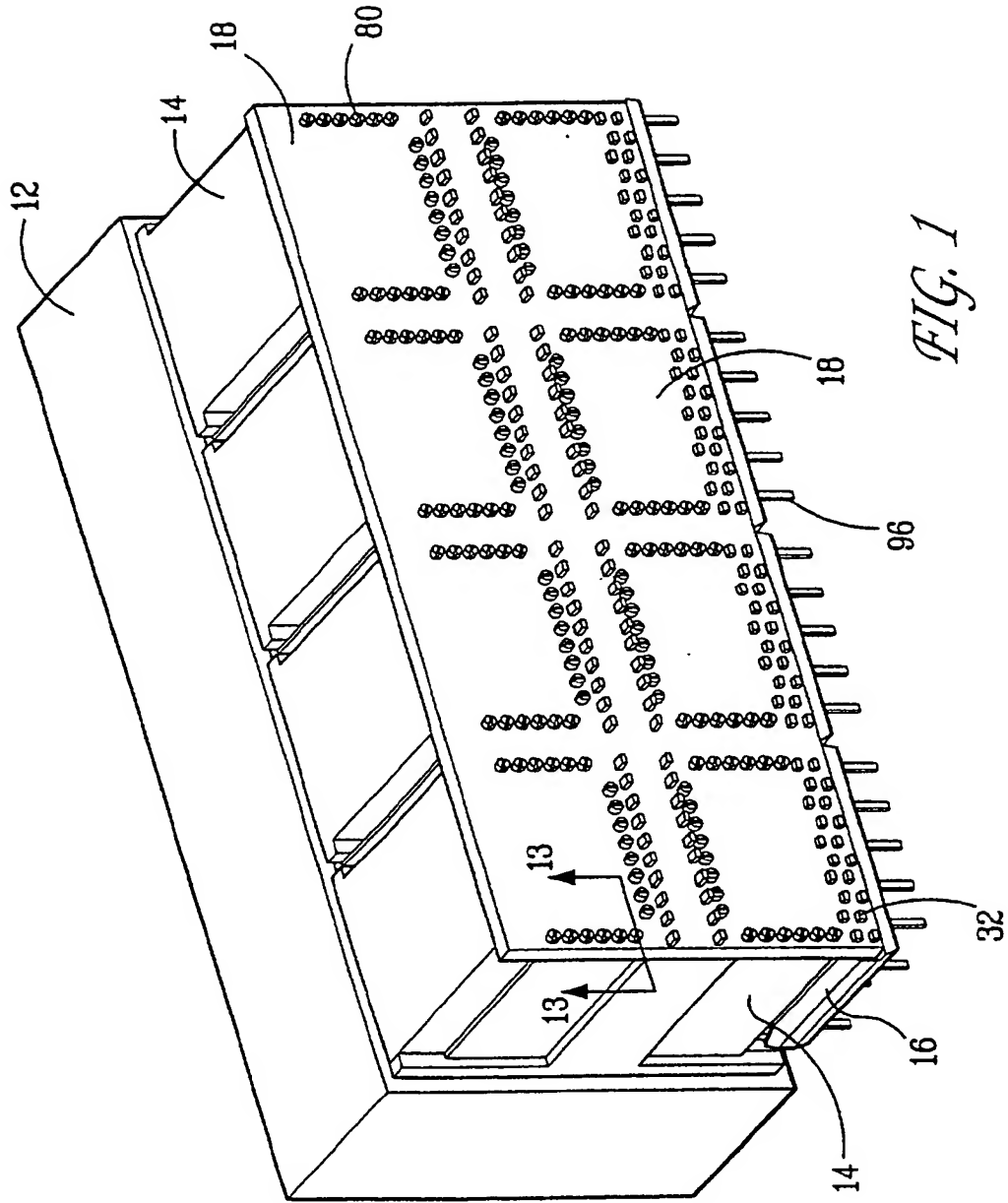
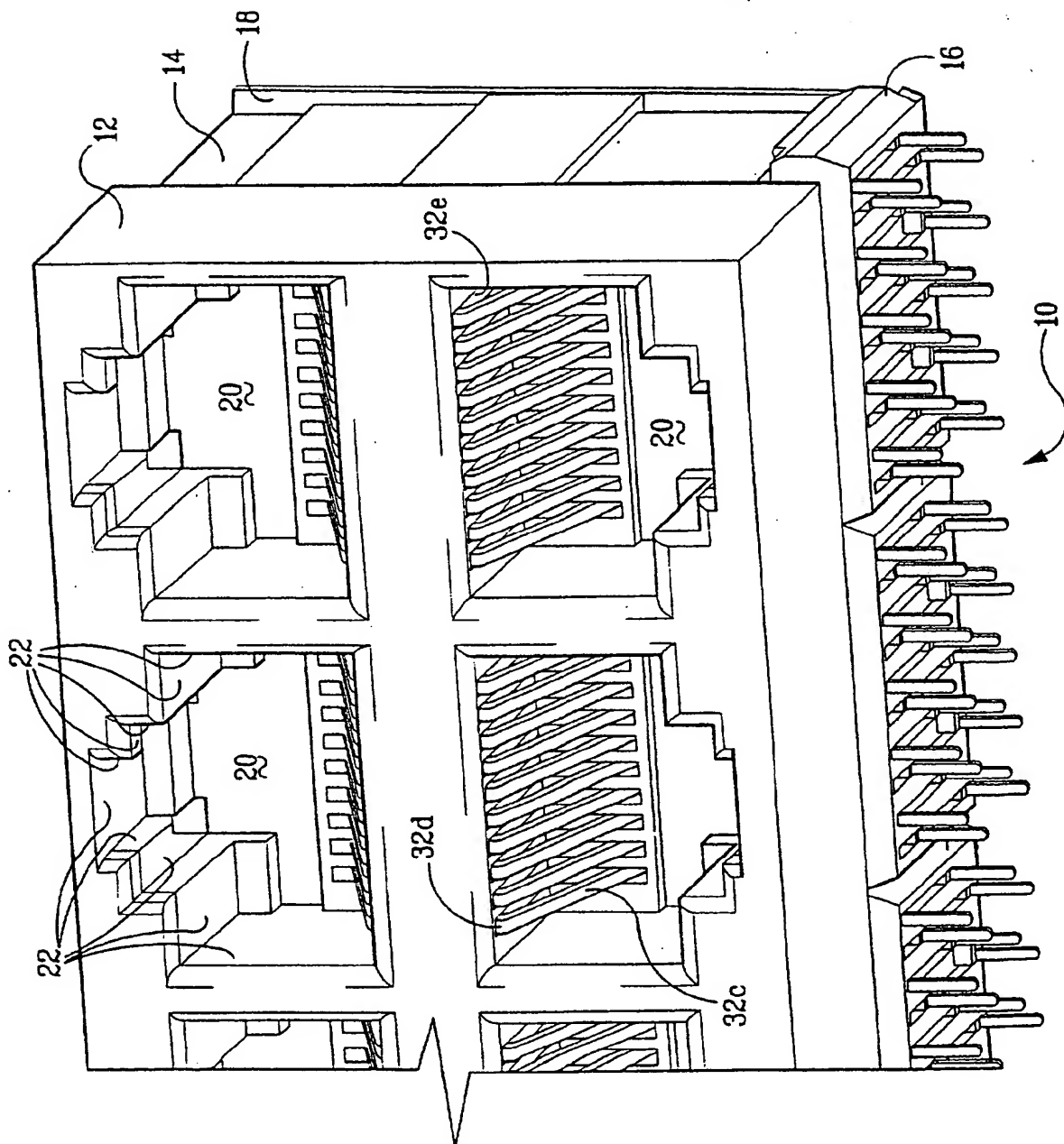


FIG. 2



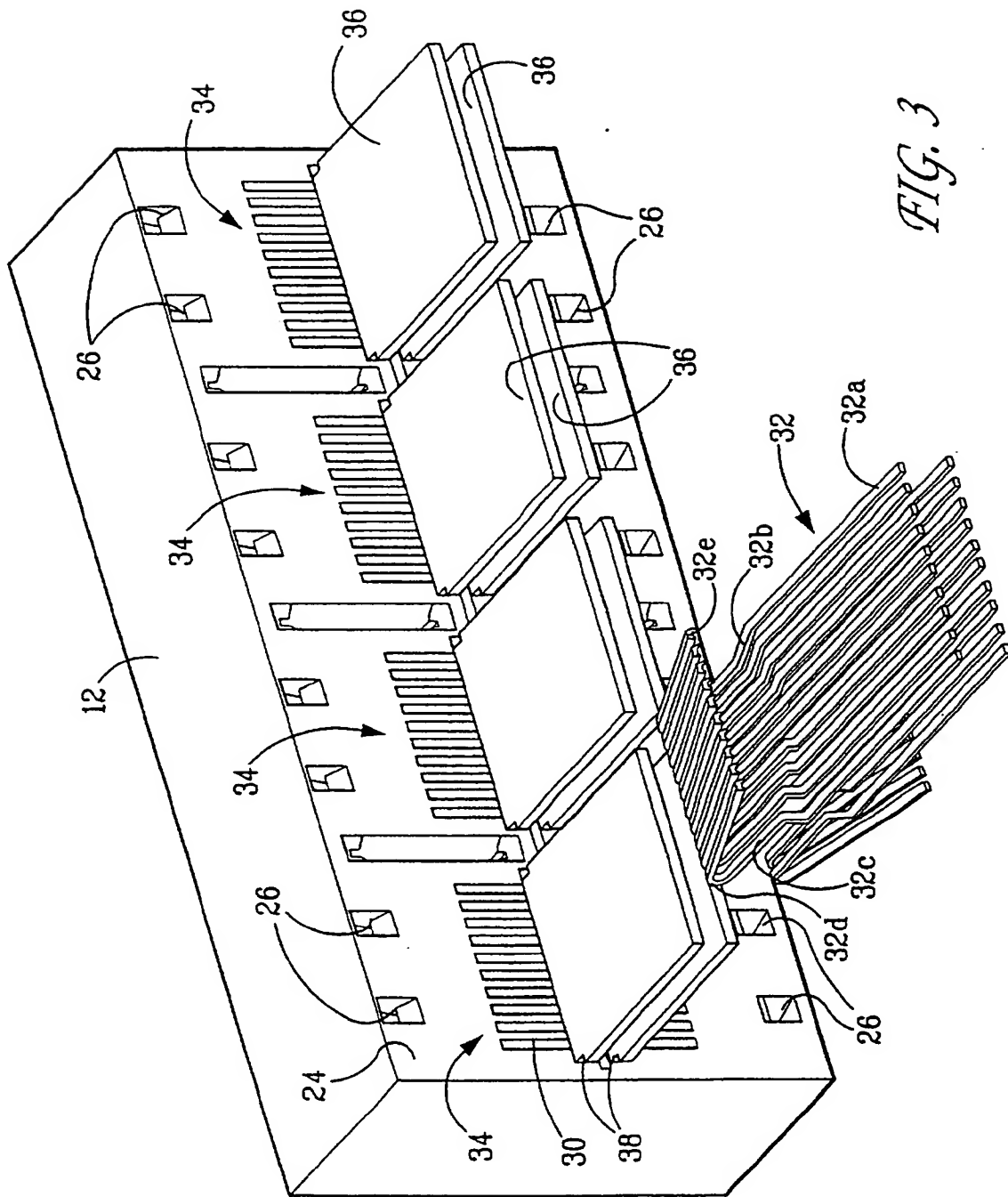


FIG. 4

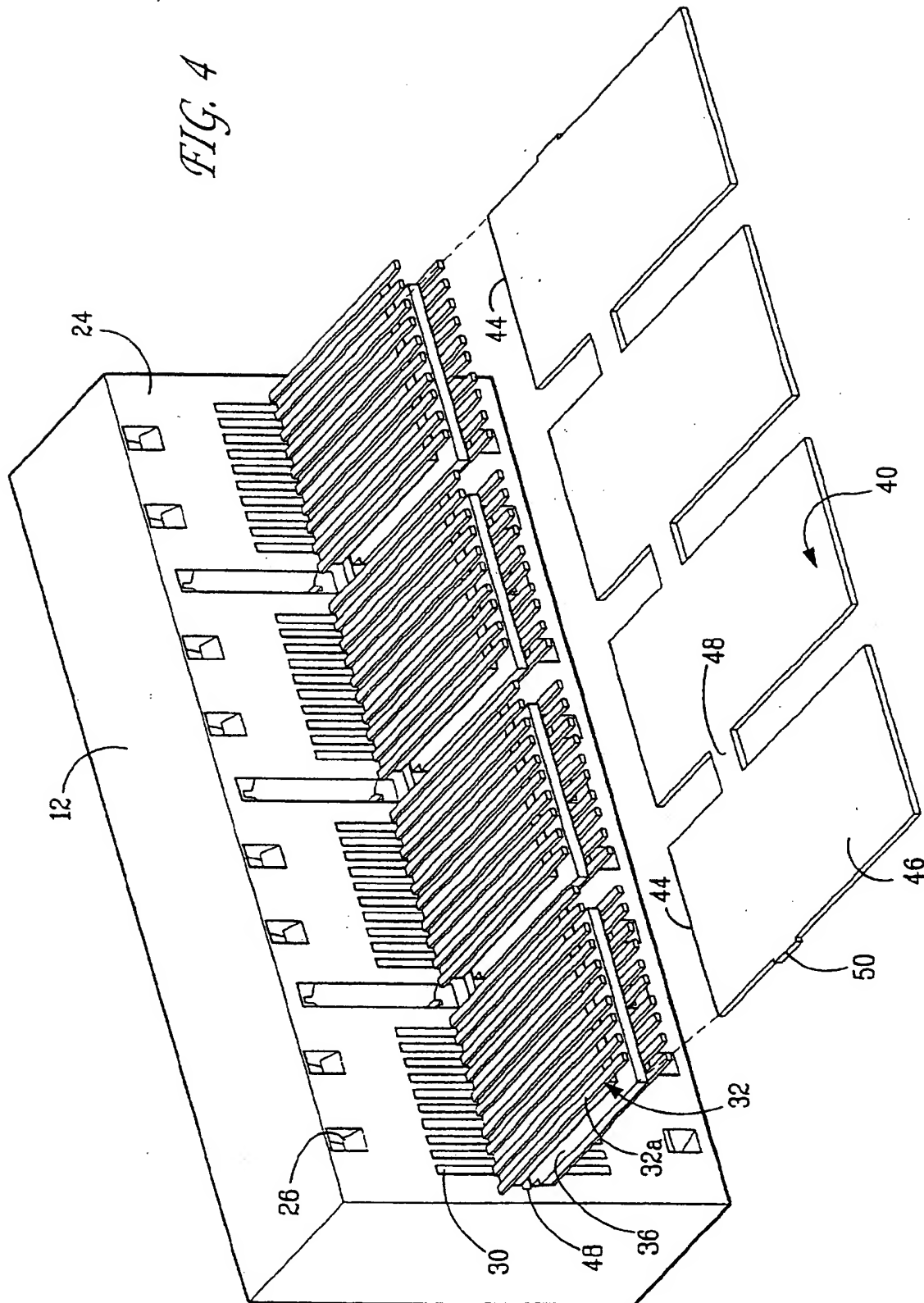


FIG. 5

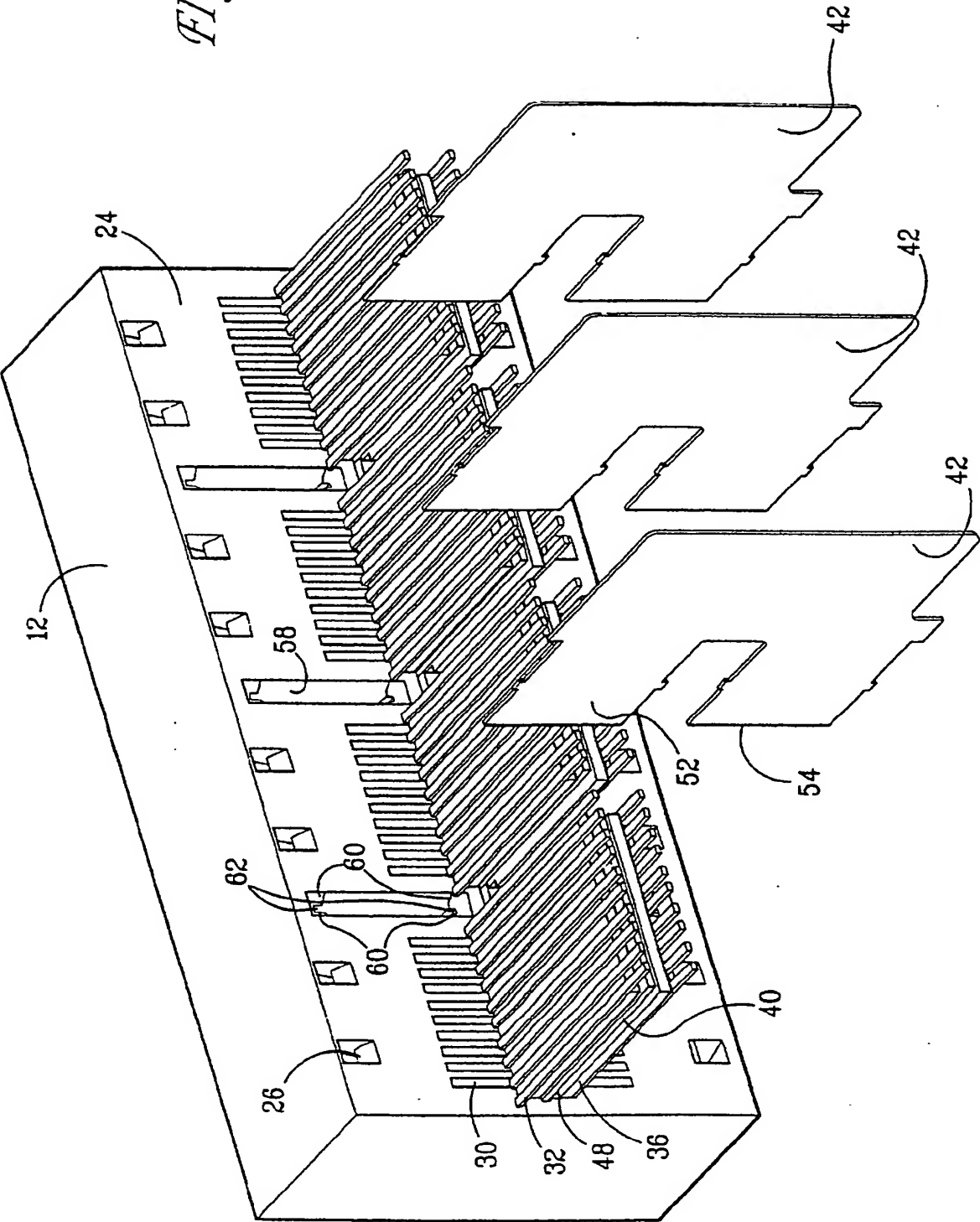


FIG. 6

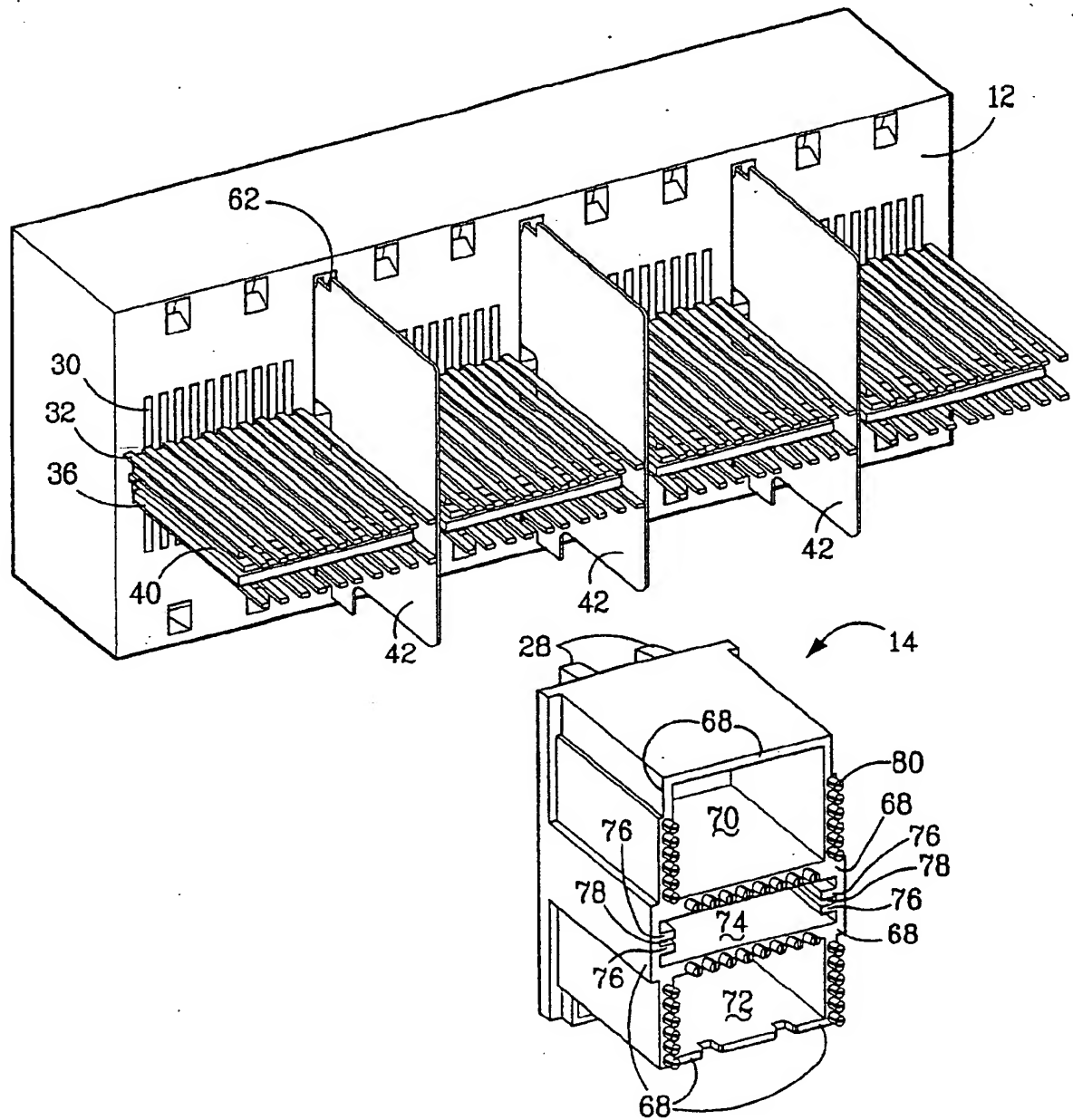


FIG. 7

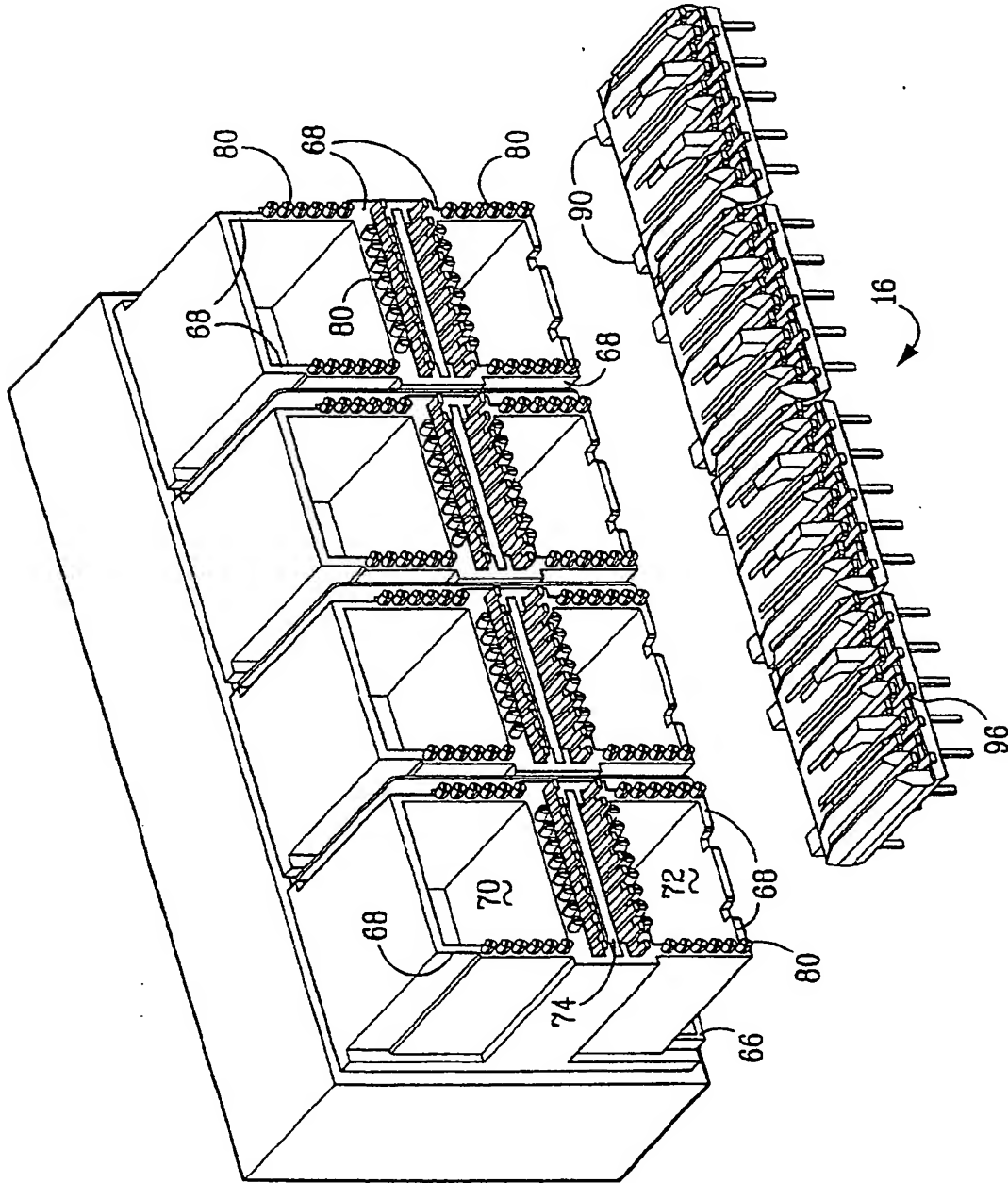


FIG. 8

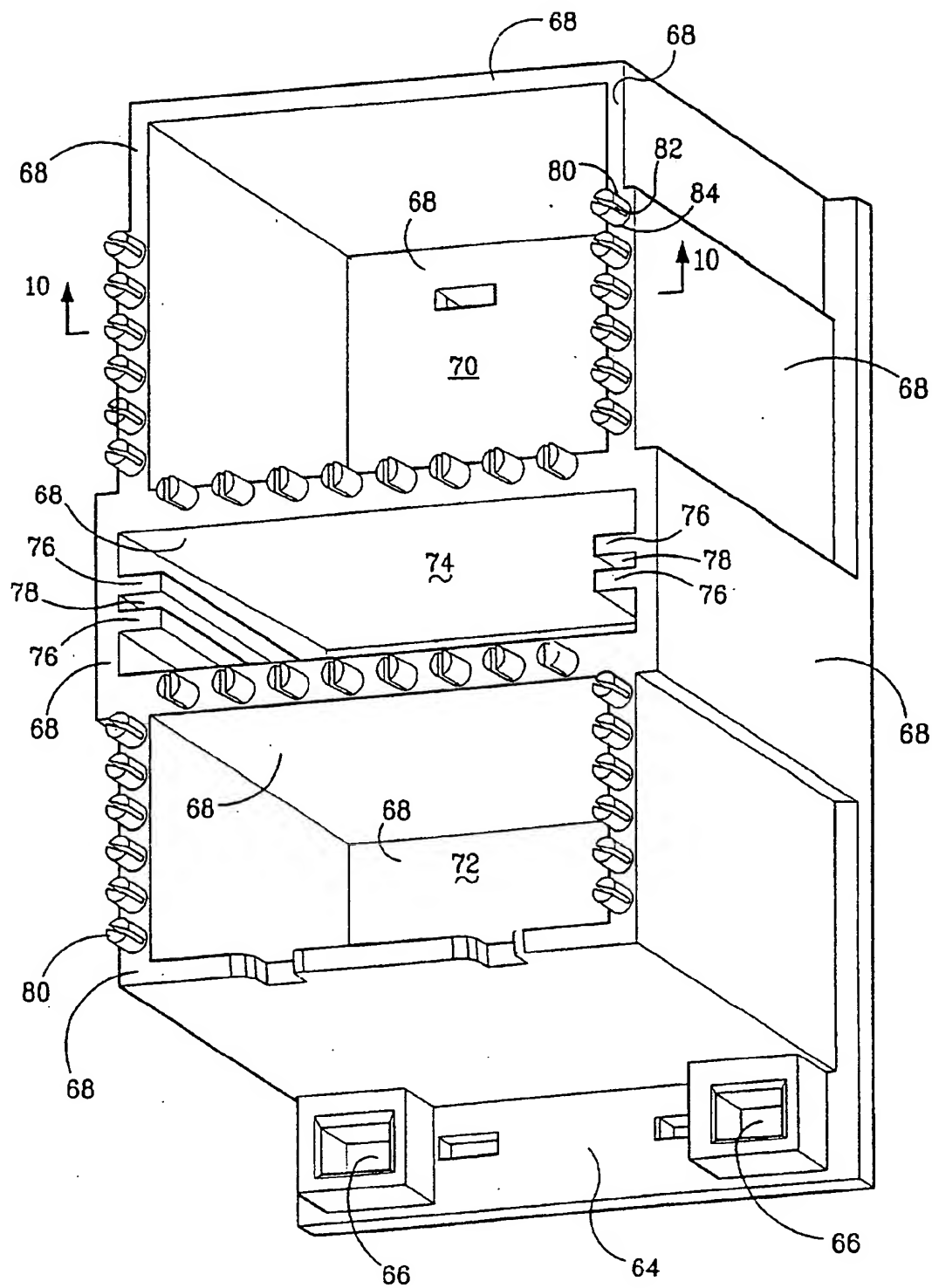


FIG. 9

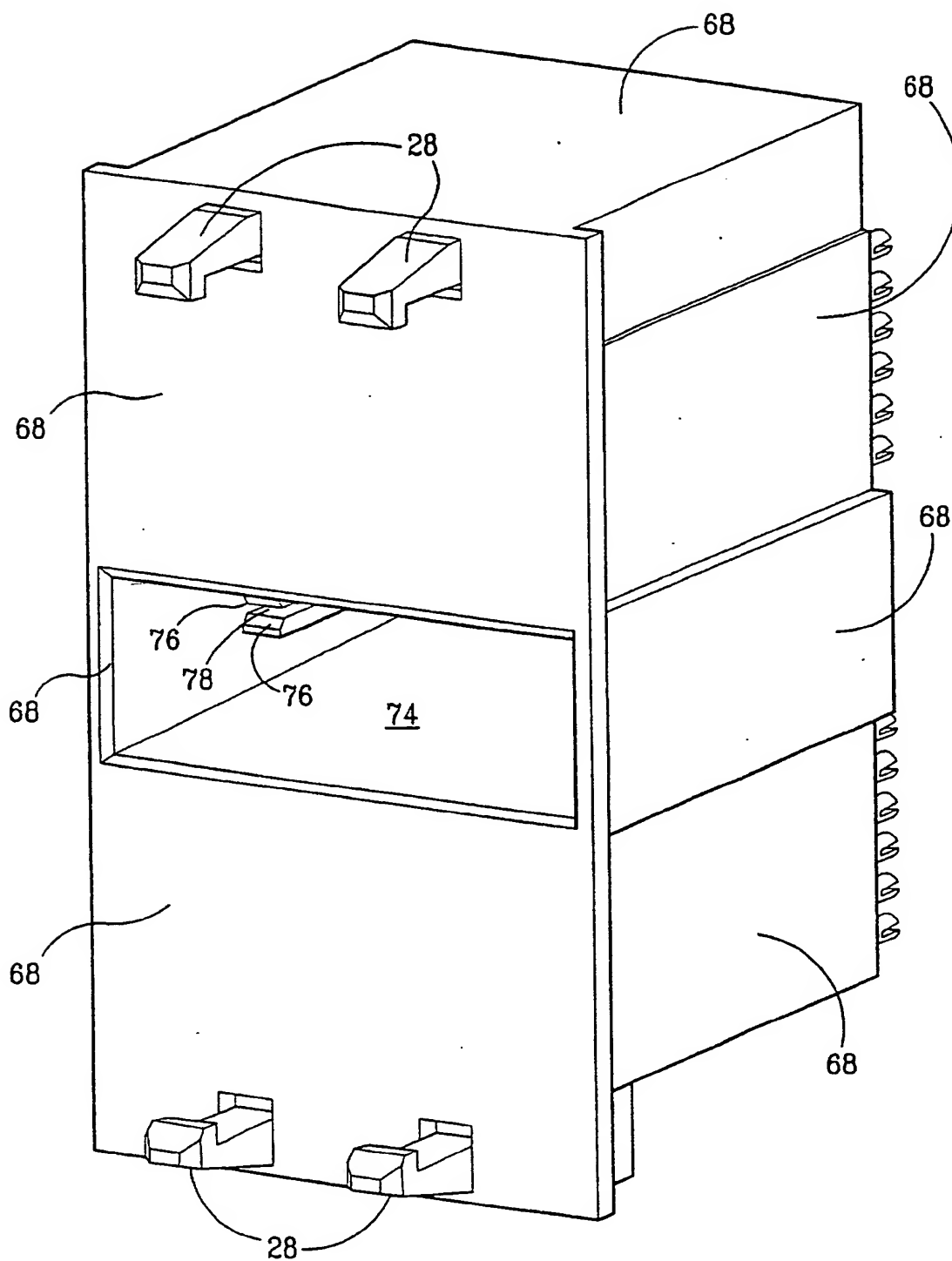
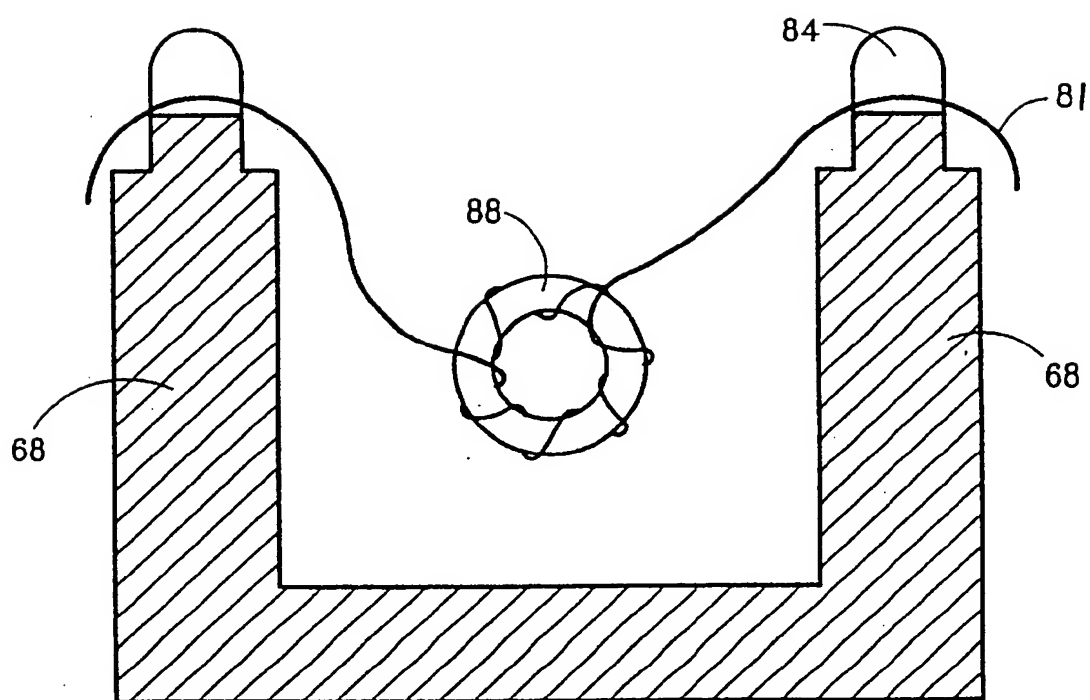


FIG. 10



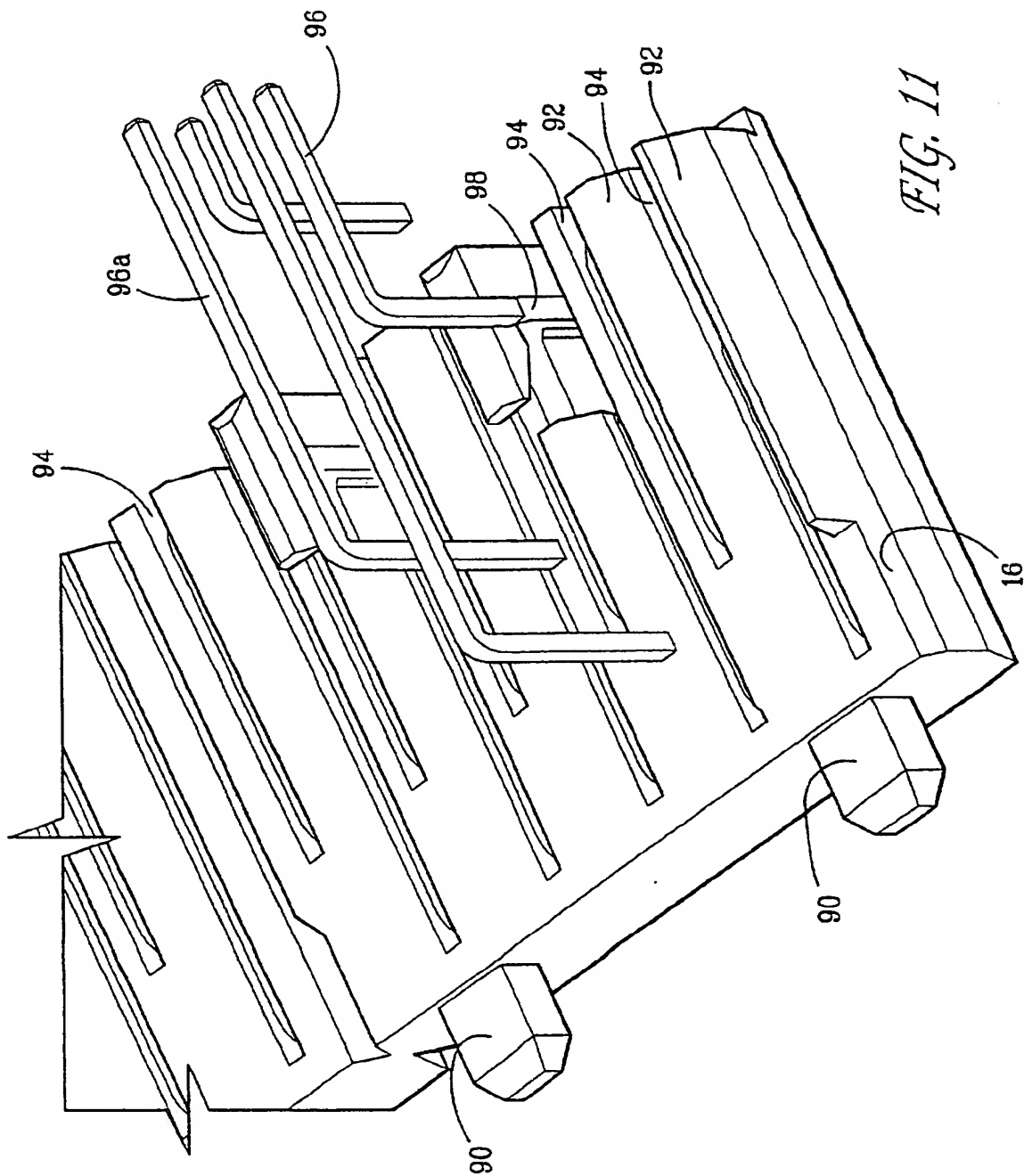
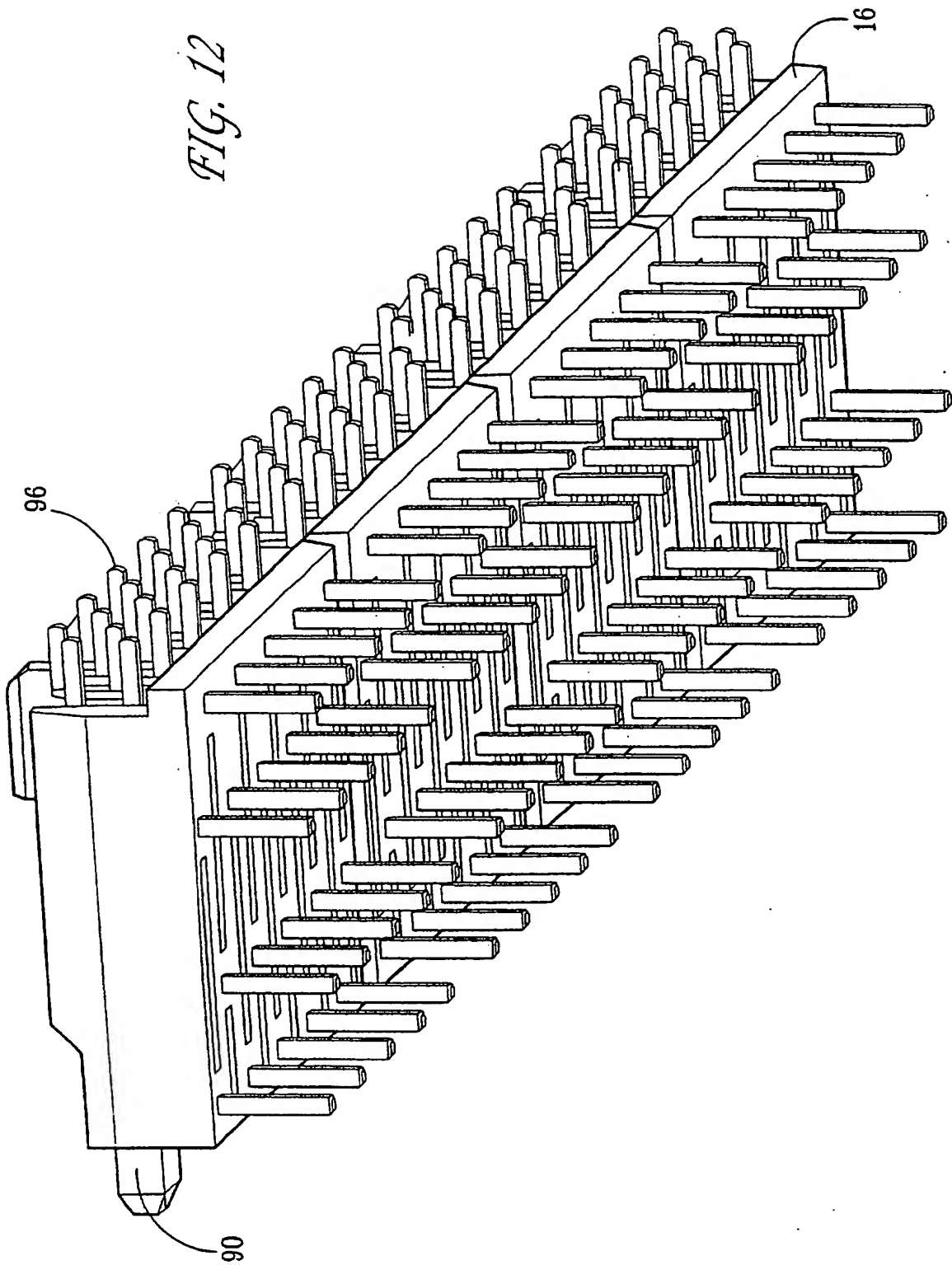


FIG. 11

FIG. 12



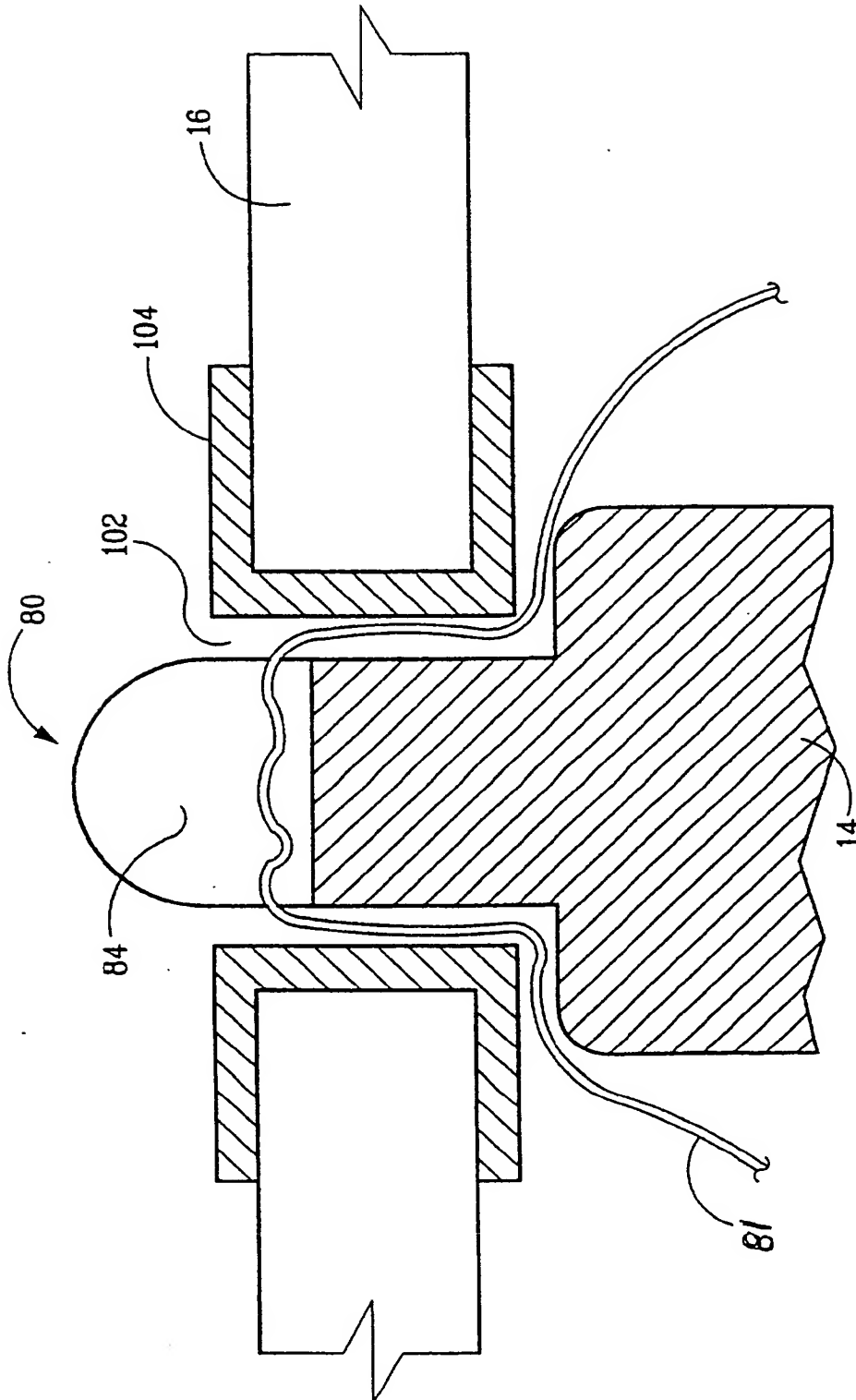


FIG. 13

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 317 023 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
14.01.2004 Bulletin 2004/03

(51) Int Cl.7: **H01R 13/514, H01R 24/00**

(43) Date of publication A2:
04.06.2003 Bulletin 2003/23

(21) Application number: **02026460.2**

(22) Date of filing: **27.11.2002**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SK TR**
Designated Extension States:
AL LT LV MK RO SI

- **Aeschbacher, Michel**
28300 Saint-Prest (FR)
- **Brubaker, Brad**
Mechanicsburg, PA 17055 (US)
- **Marshall, Robert**
Elizabethtown, PA 17022 (US)
- **Spickler, John**
Columbia, PA 17512 (US)
- **Wheeler, Bonita L.**
Red Lion, PA 16838 (US)

(30) Priority: **28.11.2001 US 996556**

(71) Applicant: **FCI**
75009 Paris (FR)

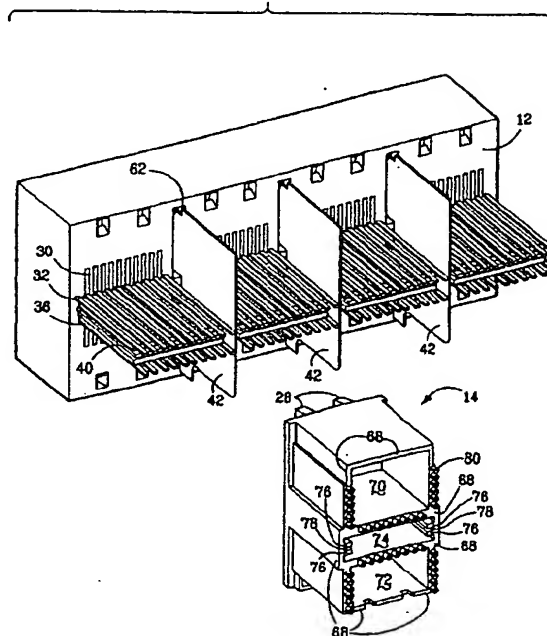
(72) Inventors:
• **Belopolsky, Yakov**
Harrisburg, PA 17112 (US)

(74) Representative: **Beetz & Partner Patentanwälte**
Steinsdorfstrasse 10
80538 München (DE)

(54) A modular jack with magnetic components

(57) A modular jack for housing magnetic components includes a housing (12) which has a plurality of ports each of which can receive an electrical connector. Extending into each of the ports are a plurality of contacts for connecting to contacts of an electrical connector. The ports may be arranged in a stacked configuration in which case the modular jack is a double deck jack. Attached to the housing may be one or more magnetic housing (14). Each magnetic housing can house at least one magnetic component, which can be a transformer. Preferably, there is a magnetic housing for every two ports, and the magnetic housing houses a magnetic component for each port. Shields (40, 42) can be installed into the housing between the magnetic components in order to provide isolation of the components. A printed wire board can be attached to the magnetic housing, and a contact carrier having a plurality of contacts can be attached to the printed wire board

FIG. 6



EP 1 317 023 A3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 02 6460

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	GB 2 347 796 A (BEL FUSE INC) 13 September 2000 (2000-09-13) * claim 2 *	1,9	H01R13/514 H01R24/00
A	WO 00 22697 A (STEWART CONNECTOR SYSTEMS) 20 April 2000 (2000-04-20) * figure 25 *	1,9	
A	EP 1 063 735 A (BERG ELECTRONICS MFG) 27 December 2000 (2000-12-27) * figures 15,17 *	1,9	
A	US 6 176 741 B1 (SHUTTER RONALD A) 23 January 2001 (2001-01-23) * the whole document *	1,9	
A	US 6 102 741 A (BOUTROS KAMAL SHAWIKY ET AL) 15 August 2000 (2000-08-15) * the whole document *	1,9	
A	US 5 971 805 A (MARSHALL ROBERT E ET AL) 26 October 1999 (1999-10-26) * the whole document *	1,9	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H01R
A	US 6 227 911 B1 (BOUTROS KAMAL SHAWIKY ET AL) 8 May 2001 (2001-05-08) * figure 2 *	1,9	
A	US 6 062 908 A (JONES TERRILL H) 16 May 2000 (2000-05-16) * column 1, line 12 - line 24 *	1,9	
A	US 5 069 641 A (FUKUTANI IWA0 ET AL) 3 December 1991 (1991-12-03) * figure 1 *	1,9	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 November 2003	Examiner Salojärvi, K
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 02 6460

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-11-2003

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
GB 2347796	A	13-09-2000	DE	10003368 A1	14-09-2000
			FR	2789236 A1	04-08-2000
			GB	2382236 A , B	21-05-2003
			TW	531945 B	11-05-2003
			US	6425781 B1	30-07-2002
WO 0022697	A	20-04-2000	AU	6429399 A	01-05-2000
			CN	1331857 T	16-01-2002
			EP	1121727 A1	08-08-2001
			JP	3416650 B2	16-06-2003
			JP	2002527876 T	27-08-2002
			NO	20011855 A	13-06-2001
			WO	0022697 A1	20-04-2000
			US	6554638 B1	29-04-2003
EP 1063735	A	27-12-2000	US	6319064 B1	20-11-2001
			CA	2312459 A1	22-12-2000
			CN	1278666 A	03-01-2001
			EP	1063735 A2	27-12-2000
			JP	2001043937 A	16-02-2001
			SG	87121 A1	19-03-2002
			TW	464089 Y	11-11-2001
US 6176741	B1	23-01-2001	AU	3656099 A	08-11-1999
			EP	1074071 A1	07-02-2001
			JP	2002512433 T	23-04-2002
			TW	434951 B	16-05-2001
			WO	9954968 A1	28-10-1999
US 6102741	A	15-08-2000	US	5872492 A	16-02-1999
			EP	0903011 A1	24-03-1999
			JP	2002514341 T	14-05-2002
			WO	9747083 A1	11-12-1997
US 5971805	A	26-10-1999	AT	227892 T	15-11-2002
			CN	1265235 T	30-08-2000
			DE	69809416 D1	19-12-2002
			DE	69809416 T2	08-05-2003
			EP	0986839 A2	22-03-2000
			ES	2187971 T3	16-06-2003
			JP	2002514348 T	14-05-2002
			WO	9854789 A2	03-12-1998
			US	6159050 A	12-12-2000
US 6227911	B1	08-05-2001	AU	5897899 A	27-03-2000
			CA	2342998 A1	16-03-2000

EPO FORM P/450

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 02 6460

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-11-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6227911 B1		DE 19983535 T0	16-08-2001
		GB 2357911 A ,B	04-07-2001
		TW 451526 B	21-08-2001
		WO 0014832 A1	16-03-2000
US 6062908 A	16-05-2000	AU 5925098 A	18-08-1998
		WO 9833242 A1	30-07-1998
US 5069641 A	03-12-1991	DE 4103321 A1	08-08-1991

EPO FORM P/459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82